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ROLLA, MISSOURI.

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TWENTY-THIRD ANNUAL CATALOGUE

OF THE

School of Mines and Metallurgy

OF THE

UNIVERSITY OF THE STATE OF MISSOURI,

ROLLA, MISSOURI.

WITH AN

OUTLINE OF THE COURSES OF STUDY

AND THE

PLAN OF INSTRUCTION.

1892.

ST. LOUIS;
MEKEEL'S PRINTING ESTABLISHMENT.

COLLEGE BUILDING.

BOARD OF CURATORS

OF THE

UNIVERSITY OF THE STATE OF MISSOURI.

Term expires January 1, 1893.

Ewing Young Mitchell, ...	Rolla.
Robert Burrette Oliver, ...	Jackson.
John Scott Clarkson, Esq., . . .	Columbia.

Term expires January 1, 1895.

Bushrod Malchus Dilley, ...	Hamilton.
Gardiner Lathrop, ...	Kansas City.
Benjamin Ross Cauthorn, ...	Mexico.

Term expires January 1, 1897.

Gideon Franklin Rothwell, . . .	Moberly.
John Rice Rippey, ...	Glenwood.
Calvin Milton Woodward, . . .	St. Louis.

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Fayette A. Jones (Missouri School of Mines, '92);
Assistant in Engineering and Mathematics.

Daniel C. Jackling (Missouri School of Mines, '92),
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Administrative Officers.

RICHARD H. JESSE,
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ELMO G. HARRIS,
Director of the School of Mines.

THOMAS L. RUBEY,
Librarian and Secretary of the Faculty.

PAUL J. WILKINS,
Proctor.

Introductory Statement.

THE School of Mines and Metallurgy is an Institute of Technology, and constitutes one of the Colleges which, taken together, form the University of the State of Missouri. It was founded in 1870, when Missouri made provisions for accepting the 330,000 acres of public land donated to her by the General Government by an Act of Congress, approved July 2, 1862, entitled, "An act donating lands to the several States and Territories which may provide Colleges for the benefit of Agriculture and the Mechanic Arts." Three-fourths of this fund was used in establishing the Agricultural and Mechanical College at Columbia and the other fourth in the establishment of the School of Mines and Metallurgy at Rolla.

The proceeds from the sale of this land, up to date, amounts to $312,000, which is invested in State certificates of indebtedness, bearing 5 per cent interest.

By an Act of Congress, approved August 30, 1890 — commonly known as the "Morrill bill" — the General Government donated to each State and Territory the sum of $15,000 for the year 1889–90, which was to be increased by $1,000 a year until it should reach the sum of $25,000, which should remain an annual appropriation. Missouri gives one-sixteenth of this fund to Lincoln Institute at Jefferson City, one-fourth of the remainder to the School of Mines and the balance to the Agricultural and Mechanical College.

By virtue of an Act of the State Legislature, approved March 26, 1891, the "direct tax," amounting to $646,958.33, refunded to Missouri by the General Government was given to the State University as a permanent endowment fund. This has been invested in a State certificate of indebtedness, bearing 5 per cent interest. The School of Mines receives one-fifth of this income.

LOCATION.

The Missouri School of Mines is located in Rolla, the county seat of Phelps County. Rolla is a city of 2,000 inhabitants, on the St. Louis & San Francisco Railroad, about midway between St. Louis and Springfield, with an elevation of 1,100 feet above sea-level. It is a pre-eminently healthful location, and has a salubrious climate.

REPORT OF THE COMMITTEE APPOINTED BY THE GOVERNOR TO VISIT AND EXAMINE THE STATE UNIVERSITY.

"Work is Victory" stands as the motto of the School of Mines Department of the State University, and the new life infused into it within two years gives promise of a brilliant future. It is not to be denied that this school has failed in the past to come up to the full measure of the expectation of those who secured its establishment. This was chargeable partly to the lack of systematic work on the part of the Faculty, partly to the failure of the management of the University to give it hearty support, and largely to the General Assembly. Great results were expected of an institution which was not supplied with proper facilities for carrying out the work demanded. The first step in the direction of properly equipping the school was made in 1885, when an appropriation was made for building and equipping a Chemical Laboratory. This enabled the school to take front rank in chemical work of all kinds, and the good results that followed warrant the assumption that, with complete equipment, the school would soon take its proper position among the great scientific institutions of the country.

The school has been reorganized during the biennial period on a practical basis, and we now regard it as a school of the highest utility and intellectual attainments, and recommend that it be provided with proper equipment. Appropriations should be made for a Metallurgical Laboratory and also for a building for the Engineering Department. The necessity of these will be fully set out in the reports of the school.

The Thirty-fifth General Assembly appropriated $5,000 to build a club-house for this school. The money was expended

under the direction of Architect H. Hohenschild, of Rolla, and the building is a credit not only to the school and architect, but to the State as well. Unless we except the Chemical Laboratory at this institution, we are satisfied that no money ever appropriated by the State for building purposes has been more judiciously expended.

The Board has expended about $5,000 from the funds of the institution in repairing and repainting the school building, grading and fencing the park, putting in new walks, digging wells, etc., and now has the entire property in excellent condition. The money has been wisely invested.

To the criticism sometimes made on this school for not having a greater number of graduates each year, your committee deem it but just to say that, in our opinion, this is largely due to three facts: First, that the facilities have not been provided for a complete education in all the branches of scientific knowledge expected to be taught here, without more time, labor and expense than the average student of limited means can afford; second, that work and proficiency alone are the touchstones to the success rewarded by diplomas from this school; third, that the demand for students who have not more than half finished the prescribed course required by this school before graduation, but who have become equipped for the work of surveyors and civil engineers to the extent that they command much greater wages than they could have done on entering the school, tempts many to make engagements that lead them away from the school before finishing the course, most of these students being of limited means.

JOHN C. PIERSOL,
W. E. PERKINSON,
GROVES M. LANE,
} Committee.

The Government of the School of Mines.

The following State Statutes relative to the School of Mines are self-explanatory:

University Established.—A University is hereby instituted in this State, the government whereof shall be vested in a Board of Curators. (R. S. 1889, Sec. 8692.)

Corporate Name.—The University is hereby incorporated and created a body politic, and shall be known by the name of "The Curators of the University of the State of Missouri," and by that name shall have perpetual succession, power to sue and be sued, complain and defend in all courts, to take, purchase and hold, to sell, convey and otherwise dispose of lands and chattels. (R. S. 1889, Sec. 8693.)

Curators, Number of.—The Board of Curators of the State University shall hereafter consist of nine members, who shall be appointed by the Governor, by and with the advice and consent of the Senate. *Provided*, that not more than one person shall be appointed upon said Board from the same Congressional District, and no person shall be appointed a Curator who shall not have attained the age of 21 years, or who shall not be a citizen of the United States, and who shall not have been a resident of the State of Missouri two years next prior to his appointment. (R. S. 1889, Sec. 8694.)

Agricultural College and School of Mines Established.—There is hereby established the Agricultural and Mechanical College and a School of Mines and Metallurgy, provided for by the grant of the Congress of the United States, as a distinct department of the University of the State of Missouri. (R. S. 1889, Sec. 8738.)

Objects of These Colleges.—The leading objects of said Colleges shall be to teach such branches as are related to agriculture and the mechanic arts and mining, including military tactics, and without excluding other scientific and classical studies, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life. (R. S. 1889, Sec. 8739.)

Right to Confer Degrees.—The Agricultural and Mechanical College and the School of Mines and Metallurgy shall have power to confer degrees suitable to their designs and courses of studies. (R. S. 1889, Sec. 8743.)

Exemptions From Taxation.—The Agricultural and Mechanical College and the School of Mines and Metallurgy, and the lands, stock, apparatus and furniture, and all other property belonging to the same, shall be exempt from State, County and Municipal taxation. (R. S. 1889, Sec. 8764.)

Professorship of Geology.—The School of Mines and Metallurgy shall be empowered to utilize all implements, instruments, charts, specimens, etc., and the Board of Curators may establish, when they deem proper, a Professorship of Geology, said geologist to supervise the geological surveys that may be made by the School of Mines and Metallurgy. *Provided*, that nothing in this chapter shall be so construed as to authorize the removal of the specimens now in Washington University, of St. Louis. (R. S. 1889, Sec. 8765.)

Academic Course of Study, etc.—That the obligation of the State to the General Government, assumed by the acceptance of the land grant of July 2, 1862, may be more fully discharged, and in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life, the Board of Curators of the State University shall prescribe and adopt a liberal Academic Course of study to be taught in the College of Mines and Metallurgy, located at Rolla, in addition to the courses now taught in said school, and may confer the degree of Bachelor of Science upon all students who shall complete said course in said school to the satisfaction of the Faculty thereof. (Laws 1885, p. 25.)

Treasurer of School of Mines.—There is hereby created the office of Treasurer of the School of Mines and Metallurgy, located in the County of Phelps, whose duty it shall be to receive, keep and disburse all moneys belonging to said School of Mines and Metallurgy, the money donated and the proceeds of the bonds issued by Phelps County for building and other purposes of said school, the proceeds of the lands donated to the Board of Curators of the State University and conveyed to the State of Missouri for the uses and purposes of said school, all moneys which shall be appropriated or apportioned for the purpose of said school, including one-fourth of the income arising from the agricultural and mechanical land fund, and all other money which may belong exclusively to said school for building or for any other purpose. He shall have the custody of the said bonds issued by Phelps County, and shall, under the direction of the Board of Curators and in accordance with the provisions of law, sell the same or borrow money and hypothecate said bonds for the purposes for which they were issued; and the said Treasurer shall perform all customary acts pertaining to his office under the direction of the Board of Curators, and make report of the same at the annual meetings of the Board. (R. S. 1889, Sec. 8766.)

To be Appointed by Curators.—The Governor shall appoint the Treasurer for the School of Mines and Metallurgy, who shall hold his office until the annual meeting of the Board of Curators, and thereafter he shall be appointed by the Board, and hold his office during the pleasure of the Board. (R. S. 1889, Sec. 8767.)

Duty of Treasurer of University.—The Treasurer of the Board of Curators shall pay over to the Treasurer of the School of Mines and Metallurgy, as soon as he shall be appointed and his bond approved, and at all times hereafter, all moneys, bonds and all property whatsoever in his hands, which have been donated or which have been or hereafter may be appropriated or apportioned, or in any manner belonging to said school for its support or for any other purpose. (R. S 1889, Sec. 8769.)

Selling Liquor to Students, How Punished.—Any person who shall knowingly sell, give, or in any manner dispose of, any intoxicating liquors to any student of the State University, or of any school, college or academy in this State, shall be guilty of a misdemeanor, and shall, upon conviction, be punished by a fine of not less than $40 or more than $400, or by imprisonment in the County Jail not less than three months nor more than one year, or by both such fine and imprisonment. *Provided*, that it shall be lawful for druggists to sell or give such liquors to any student upon the written prescription of a regular practicing physician in good standing, or upon the written order of the President of the University or College, or Principal of the School or Academy, at which such student may be in attendance, or by the written order or consent of the parent or guardian of such student. *Provided*, that nothing in this section shall be so construed as to apply to any Mercantile or Business College. (R. S. 1889, Sec. 8737.)

Plan of Instruction.

THE course of instruction at this school deals in detail with the principles and the practice of Engineering, with special reference to Mining Engineering, Civil Engineering, Mechanical Engineering, Chemistry and Metallurgy, Mathematics, Physics and Electricity. The classes are instructed by recitations, lectures, laboratory work and field practice. While a theoretical knowledge of each subject is required, great importance is attached to laboratory work and field practice as a source of mental training as well as a preparation for active pursuits. Each student is expected to spend a large proportion of his time in the laboratories, drawing rooms or in the field. In laboratory work, while a certain standard of excellence must be attained by all, the class system is not adopted. Each student, working independently of others, advances as rapidly as possible.

Thesis.—At the close of the year each member of the Senior Class presents to the Faculty a paper in which he records some independent investigation, in a subject congenial to his tastes and included in the scope of his course. These theses, together with all drawings to illustrate them, are preserved in the library of the School.

Provisions are now made for the following technical courses:

I. Mining Engineering.
II. Civil Engineering.
III. Mechanical Engineering.
IV. Chemistry and Metallurgy.
V. Mathematics and Physics.

For the satisfactory completion of any one of these courses the degree of Bachelor of Science will be given.

The requisites for admission to any of these courses are

passing grades in the subjects taught in the Preparatory Course (see page 41). The Junior year is the same for the Engineering courses; the election being made at the beginning of the intermediate year. A detailed outline of the studies for these courses is given below.

In addition to the regular courses outlined above, provisions are made for the following special courses:

I. Assaying.
II. Surveying.
III. Electricity.

For the satisfactory completion of these subjects a Certificate of Proficiency will be given. The requisites for admission to one of these courses is a knowledge of the preparatory studies of that subject.

ENGINEERING COURSES.

JUNIOR YEAR.

First Term.			Second Term.		
Hour of Recitation.	No. of times a Week.	Study.	Hour of Recitation.	No. of times a Week.	Study.
9 to 10	3	General Chemistry.	9 to 10	3	General Chemistry.
9 to 10	2	Elementary Mechanics.	9 to 10	2	Elementary Mechanics.
10 to 11	3	Descriptive Geometry.	10 to 11	3	Stereotomy.
11 to 12	5	Trigonometry,	11 to 12	5	Analytic Geometry.
2 to 5	2	Chemical Laboratory.	2 to 5	2	Chemical Laboratory.
2 to 5	2	Field Work.	2 to 5	2	Field Work.
2 to 5	1	Drawing.	2 to 5	1	Drawing.

MINING ENGINEERING.

INTERMEDIATE YEAR.

First Term.			Second Term.		
Hour of Recitation.	No. of times per Week.	STUDY.	Hour of Recitation.	No. of times a Week.	STUDY.
9 to 10	3	Analytic Geometry and Calculus.	9 to 10	2	Assaying.
			10 to 11	3	Physics.
10 to 11	3	Physics.			
			11 to 12	3	Chemical Technology.
11 to 12	3	Chemical Technology.			
			11 to 12	2	Geology.
11 to 12	2	Mineralogy.			
			2 to 3	2	Mining Engineering.
2 to 3	3	Civil Engineering.			
			2 to 5	3	Chemical Laboratory.
2 to 5	2	Field Work			
			3 to 5	2	Physical Laboratory.
3 to 5	2	Physical Laboratory.			

SENIOR YEAR.

First Term.			Second Term.		
9 to 10	3	Analytic Mechanics.	9 to 10	2	Metallurgy.
9 to 10	2	Metallurgy.	10 to 11	2	Electric Transmission of Energy.
10 to 11	2	Dynamo - Electric Machinery.	11 to 12	5	Mining Engineering.
11 to 12	5	Mining Engineering.	2 to 5	2	Physical Laboratory.
2 to 5	2	Physical Laboratory.	2 to 5	3	Chemical Laboratory.
2 to 5	3	Chemical Laboratory.			Thesis.

CIVIL ENGINEERING.

INTERMEDIATE YEAR.

First Term.			Second Term.		
Hour of Recitation.	No. of times a Week.	STUDY.	Hour of Recitation.	No. of times a Week.	STUDY.
9 to 10	3	Analytic Geometry and Calculus.	9 to 10	3	Calculus.
			10 to 11	3	Physics.
10 to 11	3	Physics.			
11 to 12	3	Chemical Technolcgy.	11 to 12	3	Chemical Technology.
11 to 12	2	Mineralogy.	11 to 12	2	Geology.
2 to 3	3	Civil Engineering.	2 to 3	3	Civil Engineering.
2 to 5	2	Field Work.	2 to 5	2	Field Work.
3 to 5	2	Physical Laboratory.	3 to 5	2	Physical Laboratory.

SENIOR YEAR.

First Term.			Second Term.		
9 to 10	3	Analytic Mechanics.	9 to 10	1	Astronomy.
10 to 11	2	Dynamo - Electric Machinery.	10 to 11	2	Electric Transmission of Energy.
11 to 12	5	Civil Engineering	11 to 12	5	Civil Engineering.
2 to 5	2	Field Work.	2 to 5	2	Field Work.
2 to 5	2	Physical Laboratory.	2 to 5	2	Physical Laboratory.
9 to 11	2	Drawing,	9 to 11	2	Drawing
	1	Practical Photography.			Thesis.

MECHANICAL ENGINEERING.

INTERMEDIATE YEAR.

First Term.			Second Term.		
Hour of Recitation.	No. of times a Week.	STUDY.	Hour of Recitation.	No. of times a Week.	STUDY.
9 to 10	3	Analytic Geometry and Calculus.	9 to 10	3	Calculus.
10 to 11	3	Physics.	10 to 11	3	Physics.
11 to 12	3	Chemical Technology.	11 to 12	3	Chemical Technology.
11 to 12	2	Mineralogy.	11 to 12	2	Geology.
2 to 3	3	Civil Engineering.	2 to 3	3	Mechanical Engineering
2 to 5	2	Shop Practice.	2 to 5	2	Shop Practice.
3 to 5	2	Physical Laboratory.	3 to 5	2	Physical Laboratory.

SENIOR YEAR.

First Term.			Second Term.		
9 to 10	3	Analytic Mechanics.	10 to 11	2	Electric Transmission of Energy.
10 to 11	2	Dynamo - Electric Machinery.	11 to 12	5	Mechanical Engineering
11 to 12	5	Mechanical Engineering	2 to 5	2	Physical Laboratory.
2 to 5	2	Physical Laboratory.	2 to 5	2	Shop Practice.
2 to 5	2	Shop Practice.		3	Machine Design and Drawing.
	3	Machine Design and Drawing.			

COURSE IN CHEMISTRY.

JUNIOR YEAR.

First Term.			Second Term.		
Hour of Recitation.	No. of times a Week.	STUDY.	Hour of Recitation.	No. of times a Week.	STUDY.
9 to 10	3	General Chemistry.	9 to 10	3	General Chemistry.
9 to 10	2	Elementary Mechanics.	9 to 10	2	Elementary Mechanics.
10 to 11	5	German.	10 to 11	5	German.
11 to 12	5	Trigonometry.	11 to 12	5	Analytic Geometry.
2 to 5	3	Chemical Laboratory.	2 to 5	3	Chemical Laboratory.

INTERMEDIATE YEAR.

9 to 10	5	German.	9 to 12	5	German.
11 to 12	3	Chemical Technology.	11 to 12	3	Chemical Technology.
11 to 12	2	Mineralogy.	11 to 12	2	Geology.
16 hours		Chemical Laboratory.	16 hours		Chemical Laboratory.

SENIOR YEAR.

9 to 10	2	Metallurgy.	9 to 10	2	Metallurgy.
30 hours		Chemical Laboratory.	30 hours		Chemical Laboratory.

COURSE IN MATHEMATICS AND PHYSICS.

JUNIOR YEAR.

First Term.		Second Term.	
2	Elementary Mechanics.	2	Elementary Mechanics.
3	Descriptive Geometry.	3	Stereotomy.
5	Trigonometry.	5	Analytic Geometry.
5	German.	5	German.
3	Drawing.	3	Drawing.

INTERMEDIATE YEAR.

3	Analytic Geometry and Calculus	3	Calculus
3	Physics.	3	Physics.
5	German.	5	German.
5	English.	5	English.
2	Physical Laboratory.	2	Physical Laboratory.

SENIOR YEAR.

3	Analytic Mechanics.	5	Mathematics.
2	Dynamo-Electric Machinery	2	Electric Transmission of Energy.
2	Physical Laboratory.	2	Physical Laboratory.
5	Senior Mathematics.	5	English.
5	English.		Thesis.

DEPARTMENT OF ENGINEERING.

PROF. HARRIS.

The term "Civil Engineering" in its original sense includes all branches of engineering not military; but the term thus used is too comprehensive to define properly the work of a specialist of to-day. Hence the necessity of further subdivision of Civil Engineering, properly so-called, into several branches, principal among which are Mining Engineering, Mechanical Engineering, and Civil Engineering in a more restricted sense, in which it applies to the art of "designing, laying out and constructing fixed structures, such as railways, canals, bridges, docks, embankments, dams, tunnels," etc. It is in this restricted but popular sense that the words "Civil Engineering" are used below in distinction from Mining and Mechanical Engineering.

All branches of engineering are necessarily based on the sciences of Mathematics, Physics and Chemistry. The distinctive title is not usually bestowed until the knowledge of these sciences is applied to some specific useful purpose. It will be seen, then, that the college work of the student must be much the same whatever special line of application he may have chosen. The distinctive features are more in the practice than in the education.

If, then, a school is well equipped for teaching one branch of engineering, but little additional facilities are required to make the training complete in other branches of engineering, so far as a college instruction can make it.

In this department constant effort is made to give the student a working knowledge of his subject. He is taught to obtain practical results in the most direct and economical way. The student is daily exercised in such problems as will come up in every-day practice. Two afternoons of each week are given to field-work or to drawing. The field-work is given during the pleasant months of October, November, April and May. The greater part of the drawing is done during the winter months. In field practice the Junior Classmen enter

the Corps as rodmen, and must do duty in that capacity before being advanced. The Intermediate Classmen enter as instrument men, and are taught easy and accurate manipulation of the instruments. The Senior Classmen are placed in charge of the field practice, and are to direct and check the work, with the assistance of the Instructor.

The Engineering Department is equipped with field instruments of the best make, sufficient to operate two full corps at once. Other instruments and apparatus will be added to meet all requirements.

One of the chief objects of the school at present is to develop the facilities for instruction in Mechanical Engineering. We are not yet prepared to offer a complete course in shop practice, but thorough theoretical instruction is given, and a good beginning has been made for furnishing the practical training.

MINING ENGINEERING.

Applicants for the degree of Mining Engineer have work in the Department of Engineering extending through three years, as follows:

JUNIOR.

FIRST TERM.

Descriptive Geometry.—Theory of parallel and of central projections as applied to the art of draughting, with constant exercises in determining orthogonal and oblique projections of familiar objects.

Drawing (see Department of Drawing).

Field Work.

SECOND TERM.

Stereotomy.—The application of Descriptive Geometry to the art of stone-cutting—obtaining the projections, templets and directing instruments for the individual stones in the various forms of structures and the construction of models of the same.

Drawing (see Drawing).

Field Work.

INTERMEDIATE.

FIRST TERM.

Field Instruments.— The field instruments of the engineer are dissected and studied in detail, their theory, construction and adjustments receiving careful attention. Their uses and capabilities are thoroughly discussed and applied in field practice.

Engineering Geodesy.— General and particular methods of traversing, triangulating, direct and indirect leveling; land, city, topographical and hydrographical surveying; United States system of subdivision of land.

Field Work.

Drawing.

SECOND TERM.

Mine Surveys.

Exploitation of Mines.—Theory of deposits in beds, lodes and pockets, prospecting, exploration and development by shafts, inclines and tunnels; underground transportation, drainage, ventilation, lighting.

Tunneling, Masonry, Quarrying.— Strengths of stone and brick, cements and mortars; foundation, stability of masonry structures.

Drawing.

SENIOR.

FIRST TERM.

Hydraulics.— Collection and measurement of water, conveyance through pipes and canals; designs of dams and pipe lines.

Prime Movers.— Hydraulic motors, steam engines and boilers, horse-power appliances.

Graphical Statics.

SECOND TERM.

Transmission of Power.— Cable, compressed air, electricity

Mining Machinery.— Pumps, ventilators, hoists, drills.

Mechanical Concentration of Ores.

Drawing.

Thesis.

CIVIL ENGINEERING.

The work of this department in Civil Engineering for the Junior year and first term of the Intermediate is identical with that assigned for Mining Engineering.

The work of the second term of the Intermediate year is as follows:

Railroad Engineering.—Surveys, construction and maintenance.

Highway Engineering.—Surveys, construction and maintenance, street paving.

Field Work.

Drawing.

SENIOR.

FIRST TERM.

(Identical with first term of Senior year in Mining Engineering.)

SECOND TERM.

Bridge Engineering.—Determination of loads, strains and dimensions for bridges, roofs and other framed structures.

Hydraulic Engineering.—Water supply of cities and towns, sewerage; irrigation.

Field Work. Drawing.

Thesis.

MECHANICAL ENGINEERING.

JUNIOR.

(Identical with Junior Mining Engineering, with shop practice substituted for field work.)

INTERMEDIATE.

FIRST TERM.

(Identical with first term in Intermediate Mining Engineering.)

SECOND TERM.

Kinematics. Drawing.

Shop Practice.

SENIOR.

FIRST TERM.

(Identical with first term in Senior Mining Engineering.)

SECOND TERM.

Transmission of Power.— Cable, compressed air, electricity.
Mechanics of Machines.
Drawing. Shop Practice.
Thesis.

DRAWING.

FIRST YEAR.

The first year's work for all regular students in the Engineering Department is almost entirely at the drawing-board. All work in Descriptive Geometry and in Stereotomy belong naturally to the Department of Drawing, and it is so intended. The student is first taught the use of the drawing instruments. Then, beginning with the simplest problems in points, lines and planes, he advances step by step to the graphical solution of the most complicated problems with which he is likely to meet in practice. Such projections as he is caused to make in his work in Descriptive Geometry he is required to shade properly — some in pencil, others by free hand pen work, others with the ruling pen, and others in water colors and India ink, thus acquiring easy and effectual use of pencil, pen and brush.

SECOND YEAR.

In the second year the work assigned in drawing is adapted to the profession chosen by the student. The students in Civil and in Mining Engineering will select some complete engineering structure and present it in simple plan and elevation — one in axonometric, another in perspective — all neatly shaded, tinted and lettered. A badly finished drawing will not be accepted, and must be replaced. All field surveys must be plotted neatly, and one topographical drawing made from notes taken in the field by the student will be required of each. The student in Mechanical Engineering will be continuously exercised in mechanical and machine drawing.

THIRD YEAR.

The Senior Classmen have a variety of exercises in Graphical Statics, and are required to present working drawings of many structures, such as bridges, arches, dams, etc. The thesis must be accompanied by drawings fully illustrating it.

Students intending to take the course in drawing will need the following outfit, and are urged to supply themselves with first-class articles at first :

One 5-inch right-line drawing pen.

One pair 6-inch dividers, with pen, needle-point, pencil and extension bar.

One pair 3-inch spring dividers.

One 3-inch dead-center bow pen.

One 8-inch horn protractor.

One 30-inch blade T square.

One 12-inch 30°x60° rubber triangle.

One 12-inch 45° rubber triangle.

One dozen ½-inch thumb tacks.

One bottle India ink.

One rubber pencil eraser, ½x½x1½.

About twenty square feet of white drawing paper.

About ten yards manilla drawing paper.

One nest saucers 2 inches diameter.

One box technical colors.

One 12-inch boxwood engineer's scale.

One card crow quill pens.

Two water color brushes.

One-half dozen No. 5 Faber pencils.

DEPARTMENT OF CHEMISTRY AND METALLURGY.

Prof. Cuthbert P. Conrad.

The courses in this school have been especially arranged to supply the needs of those who wish to prepare themselves for positions as Assayers, Chemists and Mining Engineers. Students who are desirous and capable of accomplishing special lines of work may arrange for such courses in Analytic Chemistry and Assaying as are adapted to their special requirements.

Instruction in the following courses is regularly given each session :

I. General Chemistry.
II. Chemical Technology.
III. Metallurgy.
IV. Blowpipe Analysis and Determinative Mineralogy.
V. Analytic Chemistry.
VI. Assaying.

1. *General Chemistry.*—The course includes the subjects of Chemical Physics, Chemical Philosophy, Inorganic and Organic Chemistry, and, in addition thereto, regular weekly exercises in Stoichiometry and other problems of a chemical nature. The Junior Class meets three times a week throughout the session.

Text Books.—Lecture Notes, Fowne's Chemistry.

2. *Chemical Technology.*—The general principles involved in the smelting and treatment of the ores of the metals are first considered, followed by a description and explanation of the processes employed in the manufacture of acids, salts, glass, paper, mortar, cements and other building materials, sugar, wine, spirits, oils, paints, soaps, bleaching materials, fuels, etc., etc. A general cabinet, illustrative of all branches of Chemical Technology, is being gradually collected. The Intermediate Class meets three times a week throughout the session.

TEXT BOOK.—Wagner's Chemical Technology, 13th edition.

3. *Metallurgy.*— In addition to the brief course required of the Intermediate Class, the members of the Senior Class meet weekly for the discussion of assigned topics in the Metallurgy of gold, silver, copper, zinc, lead and iron. Attention is directed to fuels, fluxes, air supply, furnaces, refractory materials, study of slags, preparation and concentration of ores, improved forms of stamps, mills and pans. The modern methods of Hydro-metallurgy and Electro-metallurgy are treated with merited fullness. Special topics are assigned to each student, upon which he is required to prepare a paper embodying the results of his reading in the authoritative works on Metallurgy, Current Literature, Journals, Transactions, etc., with which the Library is well supplied. These papers are taken up in class and critically discussed by the other students. It is expected to make visitation to the Mining and Metallurgic works of the State a part of this course.

4. *Blowpipe Analysis and Determinative Mineralogy.*— This class meets regularly three times each week throughout the first term of the Junior year. Previous to beginning regular analysis with the blowpipe, each student is required to complete a short course in blowpipe practice; after which, metals, oxides, salts and alloys are given, upon the composition of which, as determined by blowpipe tests alone, he is required to report. This work is followed by a thorough course in Determinative Mineralogy, during which the student examines, identifies and classifies 100 native minerals.

TEXT BOOKS.—Printed Notes and Schemes, Foye's Handbook of Determinative Mineralogy.

5. *Analytic Chemistry.*— This course is begun with a series of selected exercises in Manipulation and Laboratory Practice. A systematic and thorough course of Qualitative Analysis follows. After the student attains sufficient skill to enable him to determine the composition of substances given him, and to make complete and accurate separations, he is allowed to begin Quantitative Analysis.

In order to complete the full course in Quantitative Chemical Analysis, each student must complete satisfactory analyses of the following substances:

1. Zinc Sulphate.
2. Barium Chloride.
3. Potassium Aluminum Sulphate.
4. Copper Sulphate.
5. Di-Sodic Phosphate.
6. Strontium Nitrate.
7. Ammonia-Ferric Sulphate.
8. Fluor-Spar.
9. Manganese Carbonate.
10. Nickel Ammonium Sulphate.
11. Limestone.
12. Galenite.
13. Chalcopyrite.
14. Stibnite.
15. Arsenopyrite.
16. Cerussite.
17. Calamine.
18. Orthoclase.
19. Kaolin.
20. Chromite.
21. Hematite.
22. Cast Iron.
23. Spelter.
24. Lead.
25. Regulus.
26. Blast Furnace Slag.
27. Lead Furnace Slag.
28. Pyrolusite.
29. Bleaching Powder, valuation.
30. Soda Ash, valuation.
31. Coal, proximate, ultimate and heating power.
32. Borax.
33. Beryl.
34. Potable Water.
35. Mineral Water.
36. Guano.
37. Super-Phosphate.
38. Sugar.
39. Potassium Ferrocyanide.

Applicants for the degree of Mining Engineer omit all after No. 28.

Text Books.— Clowe's Handbook, Thorpe, Bolton, Classen, Fresenius, Crookes.

6. *Assaying.*— The course in Assaying begins with the second term of the Intermediate year, usually about February 1. This work is completed in five months.

Special attention in this course is given to the rapid estimation and valuation of ores and furnace products, both by the fire and wet assay.

Fire Assays.— Gold and silver ores, also mill checks, are made the subjects of special study, and assays, both by the

CHEMICAL LABORATORY.

crucible and scorification methods, are required. Lead and copper ores are assayed by fire methods applicable to the ores in question.

WET ASSAYS.— Volumetric methods are carefully studied and applied to the rapid determination of copper, zinc, iron, etc., etc.

TEXT BOOKS.— Rickett's Assaying, Sutton's Volumetric Analysis.

Special students may pursue, by permission, the study and analysis of any class of ores or metallurgic products. Young men who have neither the time nor means to spare to take the full course may accomplish much in the way of chemical analysis and assaying by devoting their entire time to it during a single year.

All Laboratory students furnish their own blowpipes, platinum, crucibles and apparatus, silver and gold solutions, and pay for gas and fuel consumed and for apparatus damaged or broken.

A deposit of $5 per term, covering the value of the apparatus and chemicals issued, is required to be placed in the hands of the Treasurer by each Laboratory student. This deposit, less the value of material consumed, is returned at the close of the year.

THE CHEMICAL LABORATORY.

The Chemical Laboratory has been in use five years, and has been found satisfactory. It was planned and built solely with reference to the work in the school, and the entire building is used by the Chemical Department.

In this building there are the following departments: The quantitative laboratory, the qualitative laboratory, professor's laboratory, lecture room, assay laboratory and weighing room, a quantitative and qualitative evaporating room, preparation room, a supply room and two basement rooms, furnishing accommodations for seventy-five students.

In the construction of this Laboratory no pains were spared to make the Assay Laboratory complete in every respect. It

is located on the first floor, and not in the basement. The reduction furnace, as well as the muffle furnaces, are of the newest and best. Two large muffle furnaces, two smaller ones, one gas furnace, an ore crusher, pulverizing plate, ore and assay balances, with other facilities, are provided for the use of students.

Facilities for securing heat, light and ventilation are excellent; ample provision is also made for carrying off foul and dangerous gases. All parts of the building are thoroughly and judiciously equipped; nothing has been left undone to make this laboratory one of the most complete in the country. Gas and water are supplied to each table.

The laboratory contains, in addition to a large assortment of the apparatus regularly and ordinarily met with in well equipped institutions, three of Becker's Analytical Balances, Contact and Reflecting Goniometers, and other valuable pieces of apparatus for work and research.

The Chemical Laboratory is open to students for work daily from 8 A. M. to 5 P. M.

DEPARTMENT OF MINERALOGY AND GEOLOGY.

TEMPORARILY ASSIGNED TO PROF. CONRAD.

The instruction on these subjects begins with Determinative Mineralogy in the Junior Year, and is continued with Systematic Mineralogy, Petrology and Geology in the Intermediate year.

Models, diagrams, natural crystals and goniometers are used in imparting a knowledge of the principles of Crystallography.

The course in Mineralogy is fully illustrated by a complete and well arranged cabinet of minerals.

In addition to the usual course of Dynamical, Structural and Historical Geology, special attention is given to Chemical and Economic Geology. The course of instruction embraces

the origin of vein stones and ore deposits, mineral waters, coal, petroleum and natural gas.

The study of Geology is made interesting and practical by complete stratigraphical and paleontological collections, and by field work and excursions.

DEPARTMENT OF MATHEMATICS.

PROF. RICHARDS.

Great importance is attached to the study of Mathematics wherever it forms a part of the curricula. The Department offers, beyond the Preparatory Course, which completes Algebra and Geometry, three years' work, different amounts of which, as will be seen by the subsequent statements, are required in different courses. In order to enter the Junior Class, which begins with Trigonometry, the student must either have completed the Preparatory Course here or have stood a satisfactory examination upon as much Mathematics as is contained in it.

In the Engineering courses the ultimate intention of the student is kept prominently in mind, and such points as have an especial bearing upon his technical work are emphasized as occasion may suggest. The tendency, however, too frequently observable in technical schools, to cramp the mathematical instruction within the limits of a meagre preparation for professional work, is avoided, and the treatment of each subject is, in general, designed to be as broad and full as may be in the allotted time.

At the same time that the facts are taught, the utility of mathematical study as a mental discipline is duly recognized, and an effort is made to promote habits of exact, logical reasoning, and to stimulate originality and independence of thought.

The Junior Class meets five times a week; the Intermediate and the Senior each three times.

At each meeting the class is examined on matter previously assigned, and, when expedient, explanations of the

text and supplementary lectures and notes are given. The student is constantly exercised in work at the blackboard, reproducing demonstrations and applying demonstrated principles to the solution of special examples.

JUNIOR CLASS.

The Junior Class studies Trigonometry, Plane and Spherical, throughout the first half of the year. The class is thoroughly drilled in the Fundamental Definitions and Formulæ. The construction and use of Logarithmic tables are taught, and numerous examples in the solution of triangles, involving the use of Logarithms, are given. Occasionally actual heights and distances are required to be calculated by Trigonometric methods.

The second half of the year is taken up with the study of the Conic Sections and a few of the Higher Plane Curves.

TEXT BOOKS.—Wells' Plane and Spherical Trigonometry, Wentworth's Analytic Geometry. *For Reference.* — Todhunter's Plane and Spherical Trigonometry, Puckle's Conic Sections, Salmon's Conic Sections, Searle's or Henck's Field Book.

This class is uniformly required in all the courses.

INTERMEDIATE CLASS.

The class begins with Analytic Geometry of Three Dimensions, studying chiefly surfaces of the second degree—the Conicoids. The remainder of the year is devoted to the Infinitesimal Calculus. The student is guarded against the error of supposing that the Calculus means some certain body of knowledge, small or large, and is taught to view it in its true light as a method of analysis, the applications of which are infinite. The logical foundation of the subject is firmly laid in the Doctrine of Limits, and the class is introduced to the applications—both geometrical and mechanical—of its principles, which are most important, both on account of the intrinsic utility of their results, and, as well, as illustrating the efficiency of the instrument which the student is learning to use.

TEXT BOOKS.—Venable's Notes on Solid Geometry, Tay-

lor's Elements of the Calculus (with Notes and Lectures). *For Reference.* — Salmon's, Todhunter's, and Williamson's mathematical works.

The above is required in Courses I, II, III, V.

For students of Mining Engineering, to compensate for larger requirements in Chemistry and Metallurgy, a briefer treatment of the above subjects, extending through one term, will be given. This will include such a short discussion of Analytic Geometry of Three Dimensions as is found in Wentworth's Analytic Geometry, and in Calculus as much grasp of essentials (from above-mentioned text and notes) as the limited time will permit.

SENIOR CLASS.

The work of this class is designed only for students who are taking the special course in Mathematics and Physics (V), and such others as may wish to extend their mathematical studies beyond the usual undergraduate range. The course will be susceptible of a certain amount of variation from year to year, at the Professor's discretion, to meet the needs and accord with the purposes of the applicants.

The first half of next year will be devoted to a wider and more advanced study of Analytic Geometry and Calculus, certain chapters of Salmon's Conic Sections and Williamson's Differential and Integral Calculus being prescribed as reading for the purpose. In the second half year the class will study selected portions of some two of the following subjects: Projective Geometry (Cremona), Theory of Equations (Todhunter), Determinants (Muir's), Differential Equations (Forsyth), Quarternions (Kelland & Tait, and Tait).

Lectures on the history of Mathematics are given during the year.

A collection of the chief works on Mathematics, in English, French and German, which is contained in the Library, affords the student an opportunity of extending his research at will.

SEMINAR.

The modest beginnings of a Mathematical Seminar have been made this year. Nine men responded voluntarily to the invitation to join a club for independent mathematical study. These, with occasional visitors, meet on alternate Thursdays and listen to a lecture by the Professor or to papers by some of their own number, the meeting closing with a general discussion of the topic under consideration. Some of the subjects studied this year have been: The Early History of Mathematics; Theory of Numbers; The so-called Imaginaries, their Geometric Interpretation and Analytic Use; the Solution of Higher Equations.

DEPARTMENT OF PHYSICS.

PROF. MCRAE.

This department was organized in September, 1891, and includes the subject of Analytic Mechanics. Two rooms on the third floor and two in the basement of the main building have been fitted up as a Physical Laboratory. A workshop is supplied with the necessary tools, and the student is encouraged in designing and making, with his own hands, any special apparatus he may require. A steam engine and boiler, with the necessary shafting and pulleys, have been placed in the basement. A United States dynamo serves the double purpose of lighting the building and of furnishing a current for electrical measurements. An eleven-inch swing Reed lathe, with both foot and power attachments, allows wood and metal turning, screw cutting, etc., to be performed with facility.

APPARATUS.— The Laboratory is also supplied with the following apparatus: Atwood's machine, large air pump with accessories, standard and chemical thermometers, standard mercurial and aneroid barometers, hydrometers, sonometer and standard turning fork, Toepler-Holtz electrical machine, Leyden jars, large Ruhmkorff induction coil, Geissler's and

Crooke's tubes, Wheatstone bridges, resistance boxes, galvanometers, batteries, Weston volt-meter, telephone and telegraph instruments, Weston ammeter, Beck microscope, oxyhydrogen cylinders, three optical lanterns, lenses, glass and bi-sulphide of carbon prisms, a large porte lumiere and a fine collection of mechanical, physical and astronomical lantern slides. New instruments will be added to the Laboratory as fast as the funds of the school will permit.

Recitations, experimental illustrations and laboratory work go hand in hand throughout the course, making the instruction thorough and complete. The instruction in detail is as follows:

JUNIOR CLASS.

Elementary Mechanics.— This class meets twice a week throughout the year. The fundamental ideas and laws of force, motion, work and energy are dwelt upon at length, and great care is taken to convey to the student correct and sound notions on these important points. Magnus' Lessons in Elementary Mechanics is used as a text book.

INTERMEDIATE CLASS.

Physics.— This class meets three times a week and spends two afternoons a week in the Physical Laboratory during the entire year. The subjects studied the first term are: Meteorology, with special reference to rainfall and water supply; Heat, general principles, thermometry and calorimetry; Optics, optical instruments and photometry. The laboratory work is devoted to general measurements on the above subjects. The subjects studied during the second term are Electricity and Magnetism, and Telegraph and Telephone Circuits. The laboratory work is devoted to electrical testing.

SENIOR CLASS.

Practical Photography.— Students in the Civil Engineering course have one hour a week during the first term in practical photography. Students in the other courses can take this as an elective.

Analytic Mechanics. — This class meets three times a week during the first term.

Practical Astronomy.—One lecture a week is given during the second term to students in Civil Engineering on the practical methods of determining time, latitude and longitude.

Dynamo-Electric Machinery.—Two lectures a week during the first term.

Electric Transmission of Energy.—Two lectures a week during the second term. Electric lighting, electric railways, electric pumping, hoisting and ventilating apparatus will be studied.

Two afternoons a week throughout the year are spent in the laboratory.

Students in Metallurgy will also receive instruction in the electrical methods used in the extraction, purification and deposition of metals.

Post graduates or special students in Physics, after completing the prescribed course, may take up Mascart and Joubert's Electricity and Magnetism, Fourier's Theory of Heat, Minchin's Kinematics and Williamson's Dynamics or Practical Electrical Engineering.

Text Books and Books of Reference.—Stewart's Treatise on Heat, Thompson's Lessons in Electricity and Magnetism, Stewart and Gee's Practical Physics, Glazebrook and Shaw's Practical Physics, Ganot's Physics, Minchin's and Todhunter's Statics, Williamson's, Pirie's and Routh's Dynamics, Magnus' Mechanics, Bowser's Mechanics, Thompson's Dynamo-Electric Machinery, Kapp's Electric Transmission of Energy, Practical Electrical Engineering, Mascart and Joubert's Electricity and Magnetism, Gray's Absolute Measurements.

Academic Course.

THE following Academic Course of study was established in pursuance of an act of the Legislature of Missouri, in 1885. It is designed to make the course equal in every respect to those offered at the best academies. As now arranged, it will commend itself especially to young men who wish to fit themselves for successful business or professional life, and to teachers who wish to prepare for the higher work in their calling. Students must have completed the studies of the first year of the Preparatory Course before they can enter the regular Academic Course. A Diploma of Graduation will be granted to students who complete this course.

FIRST YEAR.

First Term.	*Second Term.*
General History,	General History,
German,	German,
Geometry (plane),	Geometry (space),
Civil Government.	Botany.

SECOND YEAR.

Elementary Physics,	Elementary Chemistry,
English and American Literature,	English and American Literature,
German,	German,
Higher Algebra.	Higher Algebra.

THIRD YEAR.

English History,	Political Economy,
Zoology,	Logic,
Psychology,	Descriptive Astronomy,
Rhetoricals.	Physical Geography,
	Book-keeping (optional).

GERMAN.—The course extends through two years, and consists of exercises in translation and conversation, and of a study of the gems of German literature. An effort is made,

first of all, to give the student a thoroughly practical knowledge of the language. In addition to this, technical students may acquire such facility in translation as will enable them to read German scientific works in the original. The excellent mental discipline that may be derived from the study of a foreign language, and the great aid that such study may afford to the understanding of one's own language, is not overlooked.

English and American Literature.—It will be seen that this subject extends through the entire year. The aim is to lead the student to form a correct estimate of the literary value of English and American productions, and also to direct his attention to the peculiar social and political condition of which the literature is an expression. Time is given to a study of the masterpieces from Chaucer's time to the present, and to a perusal of standard authorities on the literature of the language. The Library is well supplied with works of reference.

Text Book.—Shaw's History of English and American Literature.

English History.—An effort will be made to present the subject in a manner that shall illustrate the great law of national growth, in the light thrown upon it by the foremost English historians. The Library contains the works of many leading authorities on this subject, and students are required to make constant use of them.

Text Book.—Montgomery's "The Leading Facts of English History."

General History.—It is designed to give the student as thorough a knowledge as possible of Ancient, Mediæval and Modern History. For this reason it is thought best to continue this study through the entire year. Students will be enabled to lay a good foundation for future historical and literary work.

Text Book.—Myer's General History.

Civil Government.—The text book now in use (Young's Class Book) gives an analysis of the Constitution of the United States, presents a comparative view of the different State Governments, treats of County and Township organiza-

tions, and affords an acquaintance with such principles of law as are involved in ordinary business transactions. Special attention will be given the Government of the State of Missouri.

Political Economy.— Practical exercises constitute an important feature of the text book used. No attempt is made to inculcate any particular economic doctrine, but it is sought to give the student such an understanding of the principles of the science that he may apply them intelligently to the solution of such questions as may come under his consideration.

Text Books.— Elements of Political Economy, Chapin's Wayland.

Psychology.— The aim in this study is to place before the student, in as simple and compact form as possible, a few of the leading facts connected with the human mind — its powers, its capabilities, its growth, and some of the ways by which its powers may be strengthened and cultivated.

Text Book.— Hewett's Elements of Psychology.

Logic.— This study is intended to supplement that of Psychology. In the latter we have the analysis of the intellectual powers, in the former an investigation of the laws of correct reasoning. No text book has yet been selected upon this subject.

Rhetoricals.— From two to three hours each week will be devoted to this work. Students will be required to write essays, criticisms, sketches, etc. Drills in reading and speaking will be given regularly. In this connection special attention will be given to the development of the vocal organs by regular breathing and gymnastic exercises.

Physics.—In this course the object constantly held in view is to present simply and plainly the fundamental truths of Natural Philosophy. The subjects of properties of matter, sound, light, heat, and electricity are introduced upon a scientific basis and are illustrated throughout the course by experiments. The department is supplied with apparatus of all kinds necessary for this purpose.

Text Book.—Gage's Elements of Physics.

Physical Geography.—In this branch attention is di-

rected to the causes of natural phenomena. Meteorology and the Weather Bureau receive special attention.

Text Book.—Guyot's Physical Geography.

Book-Keeping.—This study is not required, but will be taught upon the application of at least five students for instruction therein. The course comprises principally Double Entry. Various kinds of business are represented, and all the modern conveniences and auxiliaries are explained and used. The student is required to finish at least six different sets of books. Those who complete these before the end of the term will be furnished with abundant material for further practice.

Astronomy.—The class in Descriptive Astronomy meets three times a week during the second term and pursues the subject as given in Newcomb and Holden's Astronomy.

Chemistry.—In this course instruction is given by both inductive and deductive methods. Students are supplied with work-tables, apparatus and chemicals, and under the supervision of the instructor they perform all of the experiments given in Norton's Elements of Chemistry. One meeting of each week is given up to careful and searching questioning and drill in the recitation room. The class meets three times each week throughout the second term.

Mathematics.—The Academic Course in Mathematics begins with Geometry and continues through Higher Algebra. The preparation necessary for this course is a good knowledge of Arithmetic and Elementary Algebra.

Text Books.—Wells' Plane and Solid Geometry, Wells' University Algebra, with Lectures.

Botany.—The course comprises the elements and principles of descriptive and systematic Botany, together with occasional lectures on the economic uses of various plants. The student is required to begin the analysis of plants as soon as they begin to bloom in the spring, and to continue analyzing till the end of the term. Frequent botanical excursions by the class are insisted on for the purpose of familiarizing the student with the haunts and habits of all the common plants of the vicinity.

Text Books.—Gray's School and Field Book.

PREPARATORY COURSE.

THIS course is maintained for the benefit of those students who find it necessary to give themselves special preparation for the advanced courses. The completion of this course admits the student to any of the advanced courses without examination.

COURSE OF STUDY.

First Term.	*Second Term.*
FIRST YEAR.	
Higher Arithmetic,	Higher Arithmetic,
English Grammar,	Composition and Rhetoric,
Elementary Algebra,	Algebra,
United States History,	Physiology and Hygiene.
SECOND YEAR.	
English,	English,
Higher Algebra,	Higher Algebra,
Elementary Physics,	Solid Geometry,
Plane Geometry,	Elementary Chemistry.

MATHEMATICS.—A thorough knowledge of elementary Algebra and Geometry is absolutely essential to any successful prosecution of the higher branches of Mathematics, and this course is framed to give those who are insufficiently prepared in these subjects an opportunity to obtain the requisite acquaintance with them. The studies of the first year are Arithmetic and Elementary Algebra. To Arithmetic one year is devoted; to Algebra, two. Students who can produce satisfactory evidence of a sufficient knowledge of Arithmetic will not be required to pursue that study. The object of the course is to give the student a comprehension of the principles involved in the elementary branches and a thorough acquaintance with their immediate application. The solution of original problems, so valuable both as an exercise and a test of acquirement, is made a prominent feature of the course.

In Arithmetic the vital principle and not the mere mechanical rule is what is sought to be inculcated, and the working of examples is a means, not an end. Incidentally, short methods of multiplication and division are introduced and insisted upon. In Algebra, the course begins with the fundamental operations and extends through Quadratic Equations and the Progressions. The class in Geometry completes the usual course in old Geometry, Plane and Solid.

Each class meets daily (five times a week) for one hour. The text books and scheme of work are as follows:

First Term. — Arithmetic, Barnes' National. Algebra, Wells' Academic to Simple Equations, containing more than one unknown.

Second Term.—Arithmetic, completed; Algebra, Wells' Academic, completed.

The special feature of the second year's work is an extended course in Algebra. This will include a hurried review of the elementary processes, a wider discussion of problems leading to equations, with the interpretation of their results, Theory of Exponents, Surds, Imaginaries, the Progressions, Permutations and Combinations, Binomial Theorem, Series, Logarithms, Theory of Numbers, Determinants, with an introduction to the Theory of Equations.

Text Book.—Wells' University Algebra, with Lectures.

At the same time, the class takes a thorough course in the old (Euclidian) Geometry, with numerous original exercises. Text book—Wells' Plane and Solid Geometry.

This is recognized as an important period in the student's work and every effort is made to have him acquire that firm basis without which his subsequent superstructure cannot be stable. His attention is called to the logical processes involved in the demonstrations, and an attempt is made to have him apply the same rigorous methods to his own thought. Principles learned are constantly illustrated and impressed by requiring their application to the solution of problems. Incidentally the student is acquainted with the noteworthy facts in the origin and development of the subject which he is studying.

ENGLISH GRAMMAR.—A familiarity with forms and with principles of construction is insisted upon. Written exercises are required daily, from the belief that painstaking practice under proper supervision is the best, if not the only, means of acquiring facility in the use of good English.

Text Book.—Longman's Grammar.

COMPOSITION AND RHETORIC.—It will be seen that this subject follows immediately, as it naturally should, upon that of Grammar. The student is required to practice letter writing at the very beginning of the work. From this style of composition to others, the steps are taken with ease. Instruction is given with a view to practical results: it is designed not only to impart a knowledge of principles, but also to develop a facility in the application of them.

Text Book.—Hill's Elements of Rhetoric and Composition.

AMERICAN HISTORY.—An attempt is made to impart a knowledge of the causes and effects of the important events of history rather than to fill the mind of the student with an undigested mass of detail. Especial attention is given to the history of our country under the Constitution. The drawing of historic maps, recitations from topics assigned, and frequent written reviews, are important features of the work.

Text Book.—Barnes' Brief History of the United States.

PHYSIOLOGY.— It is aimed to make the instruction in this branch as practical as possible, and to lead the student to obey the injunction, "Know thyself." Hints on hygiene are given, also rules for action in cases of emergency.

Text Book.— Steele's Hygienic Physiology.

ELEMENTARY PHYSICS.— This class meets three times a week during the first term. The subjects studied are Properties of Matter, Heat, Electricity and Magnetism, Sound and Light. Gage's Elements of Physics is used as a text book. A prominent feature of the course is experimental illustration, for which purpose the equipment in apparatus is excellent.

ELEMENTARY CHEMISTRY.— This class meets three times a week during the second term, and pursues the course in Chemistry outlined in the Academic Department.

General Information.

BUILDINGS AND EQUIPMENTS.

THE buildings of the School of Mines are situated in the most elevated part of the city of Rolla. They are substantial brick structures, well ventilated and lighted, and heated by the best furnaces manufactured. The main building has recently been painted and kalsomined throughout, and the Laboratory, one of the most complete in the country, has been in use but five years.

The different departments of the School are well supplied with apparatus. Several hundred dollars have been expended this year in the purchase of instruments and apparatus for the Engineering, Chemical and Physics Departments, and further purchases will be made as additional needs are felt and the financial condition of the School will allow.

The students' Club House, or Dormitory, built in 1890, contains commodious and comfortable rooms for thirty young men. Two students occupy one room. The dining hall and culinary department can accommodate sixty. This year the students pay $12 a month for board in the club house. Whenever they shall deem it desirable the students will be allowed to form themselves into a club and employ their own caterer. In this manner it is believed that they will be able to board themselves at comparatively low cost.

Students wishing to engage rooms in the club building for next year should do so before September 1, as the supply of rooms may be exhausted. To engage a room a deposit of $5 is required as an earnest of good faith on the part of the student. This money will be refunded at the opening of school whether the student shall take the room or not.

CLUB HOUSE.

EXPENSES.

A *Matriculation Fee* of $10, payable on entrance, and a *Library Fee* of $2 a term, payable on the first day of each term, are required of every student. Students who enter the first of the year pay $12 the first term and $2 the second term; students who enter the second term pay $12.

The cost of books and stationery (too variable to be introduced into a general estimate) may be assumed to average $10 during the session.

All laboratory students furnish their own blowpipes, platinum, silver and gold solutions, crucibles and apparatus, and pay for gas and fuel consumed and for apparatus damaged or destroyed. A deposit of $5 per term, covering the value of the apparatus and chemicals issued, is required to be placed in the hands of the Treasurer by each laboratory student. This deposit, less the value of material consumed, is returned at the close of the year.

Board, including fuel, lights, washing, etc., can be obtained for $12 to $15 a month.

The necessary expenses for the school year are as follows:

	Moderate.	Ample.
Matriculation fee	$ 10 00	$ 10 00
Library fee	4 00	4 00
Books, stationery and chemicals	15 00	25 00
Board, fuel, lights, washing, etc.	96 00	135 00
Total	$125 00	$174 00

RESIDENT GRADUATES.

It is hereby resolved by the Board of Curators, That hereafter all regular graduates in any department of the University, and every regular graduate of the Normal Schools established by law within this State, and the graduates of all other regularly chartered Literary and Scientific Colleges in this State with regular college classes established therein, and that are authorized by law to confer degrees and to grant diplomas to their students, shall be entitled to enter all the departments of the State University, including the School of Mines at

Rolla, as Post-Graduates, free of the payment of tuition fees, and to receive instruction in the same manner as other students in the Practical, Literary and Scientific Departments or classes (and all students taught in the University), and which they may choose to enter. *Provided*, however, that neither Law nor Medical students are included in this resolution. And also, that they may have full access to the Library of the University, with all other students, on such terms and under such rules as may be prescribed by the Executive Committee.

LIBRARY.

The Library contains 2,700 volumes. Extensive works upon Engineering, Mathematics, Chemistry, Physics, Assaying and Metallurgy afford to all students in these departments an excellent opportunity to pursue an extended course of reading in connection with their class work. The Library also contains the standard works in English and American poetry, fiction, biography and history, provided with especial view to the needs of Academic students. The following periodicals for the current year are found on the reading tables of the Library:

American Chemical Journal,
American Journal of Science,
American Journal of Mathematics,
Annals of Mathematics,
Century Magazine,
Chemical News,
Electrical World,
Engineering Magazine,
Engineering News,
Engineering and Mining Journal,
Forum,
Harper's Monthly,
Harper's Weekly,
Journal of Analytical and Applied Chemistry,
Judge,
Ladies' Home Journal,
Leslie's Illustrated Weekly,
Life,
Literary Digest,
Lippincott,
Nature,
Nation,
North American Review,
Philosophical Review,
Popular Science Monthly,
Popular Science News,

Public Opinion,
Puck,
Railroad and Engineering Journal,
Science,
Scribner's Magazine,
Scientific American,
Scientific American Supplement.

The Library is open daily from 8:30 A. M. to 4:30 P. M. Books may be taken out of the Library by the students under certain regulations.

ATHLETICS.

Through the liberality of the Curators an athletic field has been enclosed and graded for the benefit of the students. It furnishes ample space for base-ball, foot-ball and lawn tennis. An Athletic Association exists among the students, and it is hoped that means will soon be provided for the erection of a Gymnasium.

LITERARY SOCIETIES.

Two literary societies were organized during the year — the Philo Literary Society by the young men and the Alpha Club by the young women of the School. They hold weekly meetings for the purpose of improvement in debate, oratory and composition. The "Alpha" meets every Saturday afternoon and the "Philo" every Saturday evening.

TERMS AND VACATIONS.

The college year is divided into two terms of eighteen weeks each. The first term begins on the third Tuesday in September and ends about February 1. A ten days' vacation is given during the holidays to include Christmas and New Year. There is no interval between the ending of the first term and the beginning of the second. The second term ends on Commencement Day, which is the second Thursday in June. The summer vacation extends from Commencement to the beginning of school in September.

TERM EXAMINATIONS.

During the last week of each term all students are required to stand written examinations on the studies pursued, and the results of these examinations, with the average monthly grades, determine their term grades. A student, to pass, must attain at least 75 per cent. Daily oral and occasional written examinations are held during the term, both for the enlightenment of professor and student and for the purpose of checking the results of the term examinations.

MONTHLY REPORTS.

Regular monthly reports are sent to the parents or guardian of each student, showing the student's grade in scholarship for the month and giving such other information in regard to his progress, attendance, etc., as may be thought to be of interest. The attention of parents and guardians is particularly called to these reports.

DEGREES.

A Certificate of Distinction is conferred on one who has attained three-fourths of the value of the questions at an Intermediate or Final Examinatiion.

UNTITLED DEGREES.

1. A Certificate of Proficiency is conferred on one who has attained the required standard at all the examinations in any of the following special courses: Geology and Mineralogy, General Chemistry, Fire Assaying, Botany and Zoology, Physics, Geodesy, and the Preparatory Course.

2. A Diploma of Graduation is conferred on one who has passed all examinations in any of the following departments: Mathematics, Physics, Analytical Chemistry, Engineering, and the Academic Course.

SCIENTIFIC DEGREES WITH TITLES.

1. The degree of *Bachelor of Science in Mathematics and Physics* is conferred upon one who has passed examination on

all of the subjects of instruction in the course of Mathematics and Physics.

2. The degree of *Bachelor of Science in Chemistry* is conferred on one who has passed examination on all of the work of the special Chemical Course.

PROFESSIONAL DEGREES WITH TITLES.

1. The degree of *Bachelor of Science in Civil Engineering* is conferred on one who has passed examination on all of the subjects of instruction in the Civil Engineering Course.

2. The degree of *Bachelor of Science in Mining Engineering* is conferred on one who has passed examination on all of the subjects of instruction in the Mining Engineering Course.

3. The degree of *Bachelor of Science in Mechanical Engineering* is conferred on one who has passed examination on all of the subjects of the Mechanical Engineering Course.

4. The degree of *Civil Engineer*, *Mining Engineer* or *Mechanical Engineer* is conferred on one who, having graduated in Civil, Mining or Mechanical Engineering and received the Bachelor's Degree therein, has identified himself with the profession during a period of not less than three years, and during that time has demonstrated by work his fitness for his chosen profession.

COMMENCEMENT.

The annual Commencement exercises are held in the Assembly room, at the close of the work in June. The exercises consist of an address by some prominent speaker, the conferring of degrees and granting of diplomas by the Director, and an essay or oration by some member of the graduating class.

At the Commencement exercises on Thursday, June 11, 1891, the address was delivered by Rev. Waller E. Boggs, of Caledonia, Mo.

Certificates of proficiency were conferred on the following students for the satisfactory completion of the subjects indicated :

MATHEMATICS.

Dean, Geo. R.

ANALYTICAL CHEMISTRY.

Johnson, E. M.
Seamon, F. H.
Stewart, Arthur J.

ASSAYING.

Jones, F. A.
Jones, H. I.

PHYSICS.

Dean, Geo. R.
Holman, Wm. P.

The following degrees were conferred :

BACHELORS OF SCIENCE.

George R. Dean, B. Sc., Mathematics and Physics.

Sally Millard, B. Sc., General Course.

Arthur J. Stewart, B. Sc., Chemistry.

MINING ENGINEER.

Frank H. Seamon.

CONTRIBUTIONS AND ADDITIONS TO THE CABINETS AND LABORATORIES.

Session 1891–92.

Cabinet.	Laboratory.	Article.	Contributor.	Locality.
Mineralogical		Zinc Ores Lead Ores Calcite—Crystallized Blende—Crystals Fire Clay	J. L. Walker	Vichy, Phelps Co., Mo.
Mineralogical		Box of Minerals	M. Schreiber	Boonville, Howard Co., Mo.
Metallurgical		Zinc Ores Lead Ores	John Kingston.	Granby, Mo.
Mineralogical		Stalactitic Cerussite Calomine—Crystals Calomine Pseudomorph Willemite—Crystals Smithsonite—Crystals Galena—Large Crystals Smithsonite Pseudomorph Galena on Coal Aragonite Crystals Zinc Blende Cerussite—Crystals	John Kingston.	Granby, Mo.

CONTRIBUTIONS AND ADDITIONS TO THE CABINETS AND LABORATORIES—CONTINUED.

Cabinet	Laboratory.	Article.	Contributor.	Locality.
Mineralogical..	.....	Smithsonite—Crystals	J.R. Holibaugh	Joplin, Mo.
		Zinc Blende.....		
Mineralogical..	.....	Gold Telluride.....	H. I. Jones.	Colorado.
		Gold and Silver Telluride....		
		Silver Ore.....		
Geological.....	.....	Stratigraphical Series—100 Specimens.....	Purchased.....	Ward's, Rochester, N. Y.
		Paleontological Series.....		
Mineralogical..	.....	Blow-pipe Minerals — 100 Species.....	Purchased.....	Foote's, Philadelphia, Pa.
.....	Chemical..	Apparatus.....	Purchased.....	Dealers.
Technology	.....	Specimen Series White Lead Manfg.....	C. V. Petraeus.	Pitcher White Lead Works, Joplin, Mo.
Mineralogical..	.....	Crystalligraphic Series.....	Purchased.....	Foote's, Philadelphia, Pa
Electrical.....	.....	Samples of "Vulca" Electrical Wire Ducts.....	New York Insulated Wire Co.	New York City.
Technology.....	.....	Asbestos—Native	H. W. Johns Manfg. Co....	.....
		Asbestos—Fabrics.....		

WORK DONE IN THE CHEMICAL LABORATORY OF THE SCHOOL OF MINES.

Session 1891–92.

LOCALITY.	FOR WHOM.	SUBSTANCE.	ANALYSIS.	RESULTS.	ANALYST.
Montgomery City, Mo.	A. J. Robinson	Iron Ore	Qualitative.	Hematite and Calcite	E. M. Johnson.
Pierce City, Mo.	L. L. Allen	Mineral	Qualitative.	Calcite and Silica	E. M Johnson.
St. Louis, Mo.	J. S. R. Shaw	Mineral	Assay	No Silver	F. A. Jones.
Willow Springs, Mo.	F. O. Lee	2 Minerals	Qualitative.	Cobalt and Manganese	E. M. Johnson.
West Plains, Mo	M. A. Cooper	Mineral	Qualitative .	Calcite	Professor.
Burnham, Mo.	G. W. Dunning	Mineral	Assay	No Silver	D. C. Jackling.
Neosho, Mo.	W. W, Brace	Mineral	Qualitative.	Quartz and Hematite	E M. Johnson.
Rolla, Mo	W. H. Kelley	Cave Earth	Quantitative	40 per cent Fe S O_4	Jackling & Johnson
Pierce City, Mo.	L. L. Allen	Mineral	Assay	No Silver	E. M. Johnson.
Salem, Mo.	Jas. A. Berry	Mineral	Qualitative.	Limonite and Silica	E. M. Johnson.
Randolph Co., Mo.	S. B. Pierce	Mineral	Assay	No Silver	D. C. Jackling.
El Dorado, Mo.	Mike Johannes	2 Minerals	Qualitative.	Calcite, Dolomite and Clay	E. M. Johnson.
New Florence, Mo.	F. H. Kallmeyer	Stock Food	Qualitative.	Rock Salt	Professor.
Jackson Co., Mo.	H. B. Wagoner	Minerals	Assay	No Silver	D C. Jackling.
Phelps Co., Mo.	V. M. Reitz	Iron Ochre	Quantitative	Complete Analysis	Jackling & Johnson
Phelps Co., Mo	V. M. Reitz	Iron Ochre	Quantitative	Complete Analysis	Jackling & Johnson
Burr Oak, Mo.	W. R. Anderson	Mineral	Qualitative and Assay.	No Silver	D. C Jackling.
Burr Oak, Mo.	W. R. Anderson	Mineral	Assay	No Silver	D. C. Jackling.
Doniphan, Mo.	J K. Langford	Mineral	Qualitative.	Iron and Manganese	E. M. Johnson.
Howard Co., Mo.	M. Schreiber	12 Minerals	Qualitative.	Zinc, Iron, Lime and Minerals	Professor.
Vernon Co,, Mo.	Taylor & Edleman.	Minerals	Qualitative.	Lime and Iron Minerals	Professor.
Benton Co., Ark.	W. W. Brown	Mineral	Assay	No Silver	D. C. Jackling.
Benton Co., Ark.	W. W. Brown	Mineral	Quantitative	Zinc and Copper	D. C. Jackling.
Ozark Co., Mo.	W. A. Guthrie	Mineral	Qualitative.	Limonite and Pyrite	Professor.
Ozark Co., Mo.	W. A. Guthrie	Mineral	Qualitative.	Limestone and Zinc	Professor.

WORK DONE IN THE CHEMICAL LABORATORY OF THE SCHOOL OF MINES – CONTINUED.

LOCALITY.	FOR WHOM.	SUBSTANCE.	ANALYSIS.	RESULT.	ANALYST.
Jackson Co , Mo.....	Wm. Faulkenberry	Mineral.....	Qualitative and Assay..	No Silver.....	Professor.
Osage Co., Mo.....	G. I. Mathews....	Mineral.....	Qualitative..	Oolitic Dolomite	E. M. Johnson.
Jackson Co., Mo.....	H. B. Wagoner...	Mineral	Assay	No Silver.....	D. C. Jackling.
Ozark Co., Mo	N. B. Troyer	Mineral.....	Qualitative..	Iron Ochre.....	Professor.
Marble Hill, Mo.....	D. C. Clifford	Mineral.....	Qualitative,.	Calcite.....	Professor.
Randolph Co , Ark	R. H. Montgomery	Mineral.....	Qualitative and Assay..	No Silver.....	E. M. Johnson.
Phelps Co., Mo.....	Citizen.....	Mineral.....	Qualitative..	Hematite and Pyrites.....	Professor.
Jackson Co., Mo.....	D. Faulkenberry...	Mineral.....	Assay	No Silver.....	Professor.
Stone Co., Mo.....	W. Patton.....	Mineral.....	Qualitative..	Carboniferous Limestone	Professor.
Joplin, Mo.....	N. Zentner.....	Beer.....	Quantitative	Complete Analysis	Conrad & Johnson
Eureka Springs, Ark...	R. Bennett.....	Mineral.....	Assay	No Silver or Gold.....	E. M. Johnson.
Joplin, Mo.....	J. R. Holibaugh...	Zinc Ore.....	Quantitative	Zinc Carbonate, 50.59 per ct..	E. M. Johnson.
Joplin, Mo.....	J. R. Holibaugh..	Zinc Ore.....	Quantitative	Zinc Blende, 66.16 per ct....	E. M Johnson.
Joplin, Mo.....	J. R. Holibaugh...	Zinc Ore.....	Quantitative	Zinc Carbonate, 52.54 per ct..	E. M. Johnson.
Joplin, Mo.....	J. R. Holibaugh...	Zinc Ore.....	Quantitative	Zinc Blende & Carb., 61.30 p.c	E. M Johnson.
Joplin, Mo.....	J. R. Holibaugh...	Zinc Ore....	Quantitative	Zinc Blende, 66.16 per ct.....	E. M. Johnson.
Rockville, Mo.....	Thomas Vickers...	Mineral.....	Qualitative..	Rock Crystal	Professor.
Crocker, Mo.....	W. H. Murphy....	Mineral.....	Assay	No Silver.....	E. M. Johnson.
Warren, Ark.	S. N. Burns.....	Mineral.....	Assay	Silver—good trace.....	Professor.
Ranger, Texas.....	M. H. Hagaman..	Mineral.....	Assay	No Silver or Gold	Professor.
Grandin, Mo.....	H. Davis.....	ManganeseOre	Quantitative	.....	E. M. Johnson.
Rolla, Mo.	Citizen.....	Organic Anal's	Quantitative	20 Determinations.....	Professor.
Nogal, N. M.....	E. W. Parker.....	Ores.....	Assay	Silver determined	M. B. Parker.
Colorado.....	Mr. Jones.....	Ores.....	Assay	Gold.....	H. I. Jones.
Stone Co., Mo.....	W. Patton.....	Iron Ores	....	Hematite.....	Professor.
Barton Co., Mo.....	Jason Williams ...	Box Minerals.	Qualitative..	Assayed for Ag..... ..	Professor.

Richland, Mo.....	W. S. Musgrave ..	Minerals. .... Qualitative..	Assayed for Ag...	Professor.
Dade Co., Mo.....	W. R. Starr	Mineral	Assayed for Ag.....	Professor.
Nogal, N. M.....	M. B. Parker.....	Silver and Gold Ores.....	9 Assays for Au. and Ag.	M. B. Parker.
Boulder Co., Colo.....	H. I. Jones.....	Gold Bullion.....	Determined Au., Ag., Cu.,Te.	H. I. Jones.
Boulder Co., Colo.....	H. I. Jones.....	Telluride Ores.....	2 Complete Analyses	H. I. Jones.
Grand Co., Colo.....	H. I. Jones.....	Graphite.....	Complete Analysis.....	H. I. Jones.
Rolla, Mo.....	E. Y. Mitchell....	Colorado Ore.....	Assayed for Ag.....	E. M. Johnson.

The Professor in charge will answer all correspondence with reference to Missouri minerals, and when specimens are sent he will report upon them free of charge. If the specimens are thought to be worthy further analysis, and the correspondent so instructs, a small fee will be charged for the analysis or assay, which fee goes to the person doing the work. Students of the advanced classes are aided and encouraged by doing such work, and every aid and facility is afforded them for thorough and accurate results. All work is done under the personal supervision of the Professor in charge.

Chronological List of Professors.

	Elected.	Resigned
Charles P. Williams, A. M., Ph. D., Director and Professor of Chemistry and Metallurgy....	1871	1877
William Couch, Instructor in English.....	1871	1874
William E. Glenn, M. D., Lecturer on Anatomy, Physiology and Hygiene.....	1871	1874
James W. Abert, A. M., Professor Civil Engineering and Drawing.....	1872	1877
Nelson W. Allen, A. B., Professor of Mathematics and Secretary of the Faculty.....	1872	1874
John Holt Gill, Librarian.....	1872	1874
George D. Emerson, M. E., Professor of Civil and Mining Engineering.....	1873	1886
Robert W. Douthat, A. M., Ph. D., Professor of English and Secretary of the Faculty. Principal of the Preparatory Department, 1877–1884.....	1873	1884
James A. Yantis, Adjunct Professor of Mathematics and Librarian.....	1874	1875
Almon W. Hare, M. E., Assistant in the Preparatory Department and Chemical Laboratory	1874	1875
Van Court Yantis, Adjunct Professor of Mathematics and Librarian.....	1875	1878
Charles E. Wait, C. E., M. E., Director and Professor of Chemistry and Metallurgy.....	1877	1888
Edwin J. Jolly, Adjunct Professor of Mathematics and Librarian.....	1878	1880
Florence E. Whiting, Assistant in the Preparatory Department.....	1878	1883
T. C. Thomas, T. E., Adjunct Professor of Mathematics.....	1880	1881
George Z. Whitney, A. M., L. L. B., Professor of Mathematics and Librarian.....	1881	1884

	Elected.	Resigned.
J. M. Morris, A. M., Professor of Physics and Natural History	1882	1883
E. DeW. Eaton, M. S., C. E., Professor of Mathematics	1884	1888
W. G. Clark, B. S., C. E., Assistant in Mathematics and Chemistry, Librarian and Secretary of the Faculty	1884	1887
E. A. Drake, A. M., Instructor in English, Secretary of the Faculty and Librarian, 1887–1891	1884	1891
William Holding Echols, B. S., C. E., Professor of Civil and Mine Engineering and Director, 1888–1891	1887	1891
Paul J. Wilkins, B. S., Instructor in the Preparatory Department and Proctor	1887	
William H. Seamon, B. A. S., Professor of Chemistry and Metallurgy	1888	1890
Walter B. Richards, M. A., Professor of Mathematics	1888	
George R. Dean, C. E., Assistant in Mathematics and Physics	1888	1891
Chase Palmer, Ph. D., Professor of Chemistry and Metallurgy	1890	1891
Arthur J. Stewart, B. S., Assistant in Chemistry and Metallurgy	1890	1891
Elmo G. Harris, C. E., Director and Professor of Engineering	1891	
Austin L. McRae, Sc. D., Professor of Physics.	1891	
Thomas L. Rubey, A. M., Instructor in the Academic Department, Librarian and Secretary of the Faculty	1891	
Cuthbert P. Conrad, M. A., Professor of Chemistry and Metallurgy	1891	
Fayette A. Jones, Assistant in Engineering and Mathematics	1891	
Daniel C. Jackling, Assistant in Chemistry and Metallurgy	1891	

GRADUATES.

1874.

Gustavus A. Duncan, C. E.—Brick Manufacturer, 50 Bromfield Street, Boston, Mass.

*John Holt Gill, C. E.—Died, June 14, 1882.

John Wallace Pack, M. E.—Assayer U. S. Mint, San Francisco, Cal.

1875.

Francis J. Deegan, C. E.—Rolla, Mo.

Almon Warner Hare, M. E.—Chemist and Assayer, P. O. Box 381, Aspen, Colo.

1876.

Cyrus H. Emerson, C. E.

Oscar E. Garvens, M. E.

John D. Greason, M. E.

John Edward McGrath, C. E., M. A.—Assistant U. S. Coast Survey, Washington, D. C.

William C. Minger, M. E.

1877.

A. H. Ohmann-Dumesnil, M. E., A. M., M. D.—Physician and Author, 5 S. Broadway, St. Louis, Mo.

Thomas H. Milsaps, C. E.—Address not known.

James W. Pack, M. E.—Mining Engineer, DeLamar, Idaho.

1878.

William Y. Bean, C. E.

Wilton Rutherford Brown, M. E.—Assayer Hidalgo Mining Co., Parral, Chihuahua, Mex.

Lindsay L. Coppedge, C. E.—Died, 1885.

Lee R. Grabill, M. E.

Univ. of the State of Mo.

nan U. S. Engineer's

er Los Angeles Bank,

Assayer, Butte City,

Mo.

King Iron Bridge Co.

; and Merchandising,

g Engineer and Chem-
ining Engineers, Com-
ttle Rock, Ark.
Carrollton, Mo.
Sun, Cameron, Mo.

ecretary and Treasurer
wn, Ga.

h Consolidated Kansas
gentine, Kan.

st and Assayer, Butte

reede, Colo.

Frank W. Wilson, C. E. ... ting Agent King Iron Bridge Co., 18 Broadway, New York, N. Y.

UNIVERSITY OF THE STATE OF MISSOURI.

HISTORICAL STATEMENT.

The University of the State of Missouri was located at Columbia, Boone County, on June 24, 1839, by commissioners appointed and empowered to select a site under an act of the General Assembly of February 8, 1839. The main building was begun in 1840, and courses of instruction in Academic work were opened on April 14, 1841. A Normal department was established by act of March 11, 1867. The College of Agriculture and Mechanic Arts and the School of Mining and Metallurgy were made a department of the University by act of February 24, 1870—the School of Mining and Metallurgy being located at Rolla, Mo. The Law department was opened in October, 1872; the Medical department in February, 1873; and the Engineering department in September, 1877. The Experiment Station was established under act of Congress of March 2, 1887. The Missouri State Military School was created a department of the University by act of the General Assembly in 1890.

The foundation and the maintenance of the University rest on:

a. The old Seminary fund, $122,000 at 6 per cent.;

b. The new Seminary fund, act of March 29, 1872, $100,000 at 5 per cent;

c. Congressional Land Grant fund, act of July 2, 1862, $317,000 at 5 per cent.;

d. The property received from the citizens of Boone County to determine the original location, $207,900;

e. New building subscription by citizens of Boone County in 1892, $50,000;

f. The United States Experiment Station Fund, $15,000 per annum;

g. Fund from the act of Congress of August 30, 1890 (for the year 1892–3) $17,023;

h. The Anthony W. Rollins Aid fund, interest on nearly $40,000.

i. The James S. Rollins Scholarship fund, $6,000 at 5 per cent.;

j. Endowment granted by the 36th General Assembly, $646,958.23 at 5 per cent.;

k. Various gifts by individuals as foundations for prizes;

l. 55,000 acres of unsold land;

m. Appropriations for specific purposes by the legislature of the State.

These appropriations have amounted to over $1,000,000 since March, 1891, but in this sum are included the amounts entered under *e* and *j*. Besides providing for her University (which is the head of the Public School system) and for three normal schools, Missouri gives annually, for the support of her elementary public schools, the third part of her total State Revenue fund. This aid from the state is added to the local school tax. These schools receive also the income at 6 per cent. upon an endowment of $2,909,000 and at 5 per cent. upon an endowment of $237,000.

1879.

Rudolph C. Hoyer, C. E.—Draughtsman U. S. Engineer's Office, Memphis, Tenn.

Charles F. Winters, M. E.—Bookkeeper Los Angeles Bank, Los Angeles, Cal.

1880.

Arthur Carson, M. E.—Chemist and Assayer, Butte City, Mont.

Lorin X. Smith, M. E., C. E.—Rolla, Mo.

1881.

Edward B. Summers, C. E.—With King Iron Bridge Co. 1625 Madison Ave., New York.

Walter W. Wishon, M. E.—Mining and Merchandising, Butte City, Mont.

1882.

Frank W. Gibb, C. E., M. E.—Mining Engineer and Chemist, Member American Institute Mining Engineers, Commissioner of Roads and Bridges, Little Rock, Ark.

W. R. Painter, C. E., Civil Engineer, Carrollton, Mo.

Beaureguard Ross, M. E.—Editor *The Sun*, Cameron, Mo.

Ashuah B. Schrantz, C. E.

Herman Neff Van Devander, C. E.—Secretary and Treasurer North Georgia Mining Co., Cedartown, Ga.

1883.

Floyd Davis, C. E., M. E., Ph. D.

1884.

Curtis Alexander, C. E., M. E.—With Consolidated Kansas City Smelting and Refining Co., Argentine, Kan.

William M. Claypool, C. E., M. E.

Arthur Neustaedter, M. E.—Chemist and Assayer, Butte City, Mont.

Philip C. Gallagher, M. E.—Miner, Creede, Colo.

Frank W. Wilson, C. E.—Contracting Agent King Iron Bridge Co., 18 Broadway, New York, N. Y.

1885.

John R. D. Owen, M. E.—Died.

Philip R. Van Frank, M. E.—Transitman U. S. River Commission, St. Francis, Ark.

Fremont W. Wilson, C. E.

1886.

Jay Cullens, C. E.

James E. Fulcher, C. E.—Professor Mathematics and Sciences, McCune College, Louisiana, Mo.

Justo S. Martinez, M. E.

1887.

George W. Cole, C. E.—Second Lieutenant Seventh Cavalry, U. S. A.

O. Lachmund, M. E.—Chemist and Assayer, Telluride, Colo.

W. Merritt Yeater, M. E.—City Engineer, Sedalia, Mo.

George B. Wiles, C. E.—With St. Louis Bridge and Iron Co., St. Louis, Mo.

1890.

George Reginald Dean, C. E.—See 1891.

1891.

George Reginald Dean, C. E., B. Sc.—Professor Mathematics and Engineering, Coe College, Cedar Rapids, Ia.

Sallie Elizabeth Millard, B. Sc.—Post Graduate Missouri School of Mines, Rolla.

Frank H. Seaman, M. E.—With Motolino Consolidated Mining Co., La Noria, Mex.

Arthur J. Stewart, B. Sc.—Assistant Superintendent Motolino Mining Co., La Noria, Zacatecas, Mex.

OTHERS WHO PURSUED SPECIAL COURSES.

James L. Buskett.—Buskett's Assay Office, Helena, Mont.

Louis W. Buskett.—With J. L. Buskett, Helena, Mont.

William Patton Holman.—Professor of Mathematics, School of Mines, Rapid City, S. D.

CATALOGUE OF STUDENTS.

RESIDENT GRADUATE.

Millard, Sallie Elizabeth, ... Rolla.

UNDERGRADUATES.

Alexander, George Ernest, ... Maryville.
Alexander, Thompson, ... Muldrow, Ind. Ter.
Allen, Anna Artemesia, ... Rolla.
Attebery, Minnie, ... Cuba.
Barker, Jacob Forney, ... Carthage.
Bland, Richard E., ... Rolla.
Boas, Selma Fannie, ... Rolla.
Buskett, Evans Walker, ... Rolla.
Buskett, Mary Page, ... Rolla.
Clayton, Frank Ray, ... St. Louis.
Corse, Lottie Edith, ... Rolla.
Detweiler, Ora, ... Dry Knob.
Dwyer, Edward P., ... Joplin.
Dyer, Temple, ... Rolla.
Ettmueller, Otto, ... Hermann.
Florreich, Philip, ... St. Louis.
Fort, Edward Long, ... Rolla.
Fox, Homer Hastings, ... St. Louis.
Germann, Frank A., ... Rolla.
Goodwin, Annie Gill, ... Rolla.
Greenzweight, A. H , ... Rolla.
Grove, Claude D., ... Gallatin.
Grover, Carrie Belle, ... Cuba.
Guenther, Eda, ... Rolla.
Henderson, Harry Philip, ... St. James.
Herdman, George W., ... Neosho Falls, Kan.
Jackling, Daniel C., ... Sedalia.

Jackson, J. Marshall,	Albuquerque, N. M
Jamison, Blanche,	Rolla.
Johnson, Edward Mackay,	Rolla.
Johnson, Ludwell Lee,	Rolla.
Jones, Fayette A.,	Independence.
Jones, Harry I.,	St. Louis.
Kelly, Charles M.,	Knobnoster.
Kelso, Thaddeus Sands,	Springfield.
Kerr, William Christian,	St. Louis.
Kachelhofer, J. M.,	Starke, Fla.
Lepper, Jennie Edith,	Rolla.
Lewis, Harry E.,	St. Louis.
Lombar, Frederick E.,	Iberia.
Lowe, Parker Lee,	Independence.
Lunbeck, George Albert,	Rolla.
McCaw, Margaret,	Rolla.
McMullin, Richard William,	Hillsboro.
Manning, Harvey Elmer,	Lebanon.
Martin, Grace,	Sullivan.
Meriwether, Carl,	Rolla.
Millard, Linna,	Rolla.
Mitchell, Walter,	Rolla.
Morris, Joseph Evans,	Rolla.
Morrow, Samuel Lynn,	Fort Smith, Ark.
Nicholson, Algernon P.,	Fort Worth, Tex.
Nicholson, Ross,	Fort Worth, Tex.
Northrip, Joseph Riley,	Stoutland.
Oatley, John Arthur,	Rolla.
Parker, Morris Brown,	White Oaks, N. M.
Patterson, Oscar Flanklin,	Lebanon.
Patterson, Walter Merriam,	Ree Heights, S. D.
Phariss, Ida,	Rolla.
Reid, John Calum,	Pleasanton, Kan.
Richardson, Ethelyn,	Rolla.
Richardson, Grace,	Rolla.
Rowden, William E.,	Stoutland.
Sappenfield, Estella A.,	Rolla.
Sappenfield, Olive,	Rolla.

Smith, Tennie Estelle, ... Rolla.
Soest, Adele, ... Rolla.
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